Token Engineering
Community

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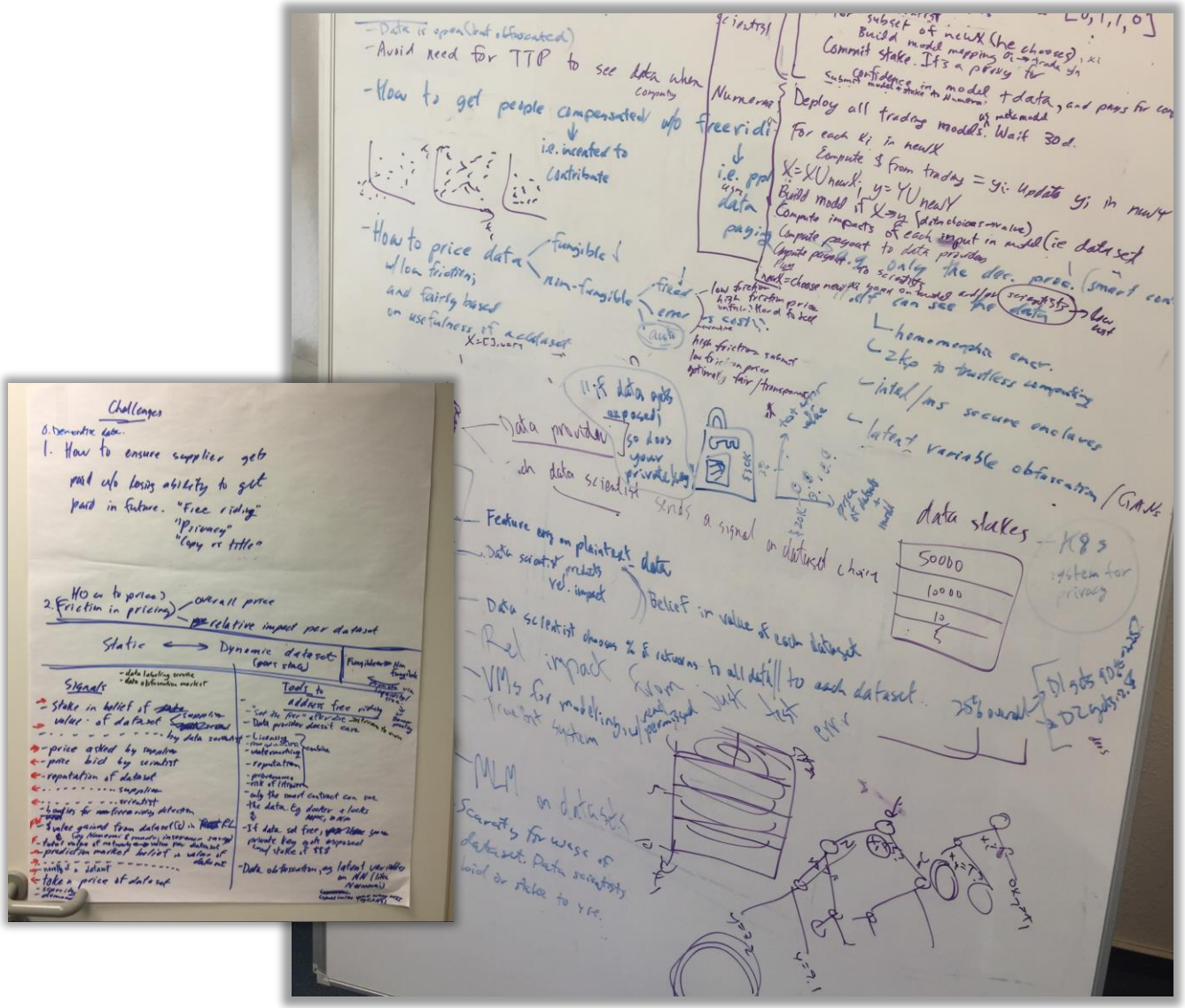
“Show me the incentive
and I will show you the outcome.”

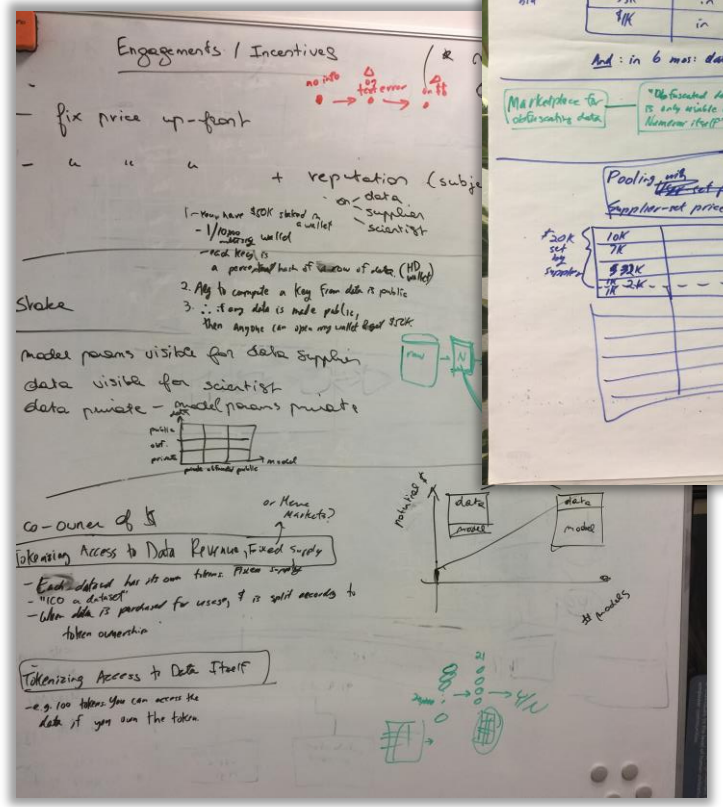
-Charlie Munger

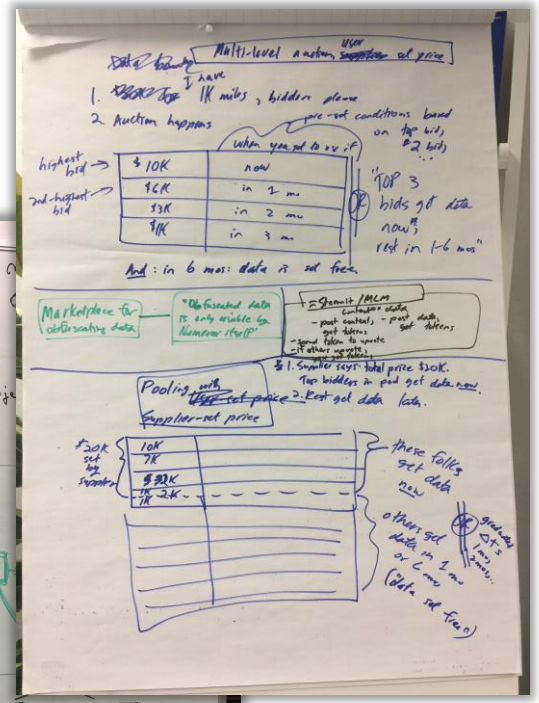

“Incentive Machine”
Get people to do stuff
By rewarding with tokens

A Personal Journey of Token Design

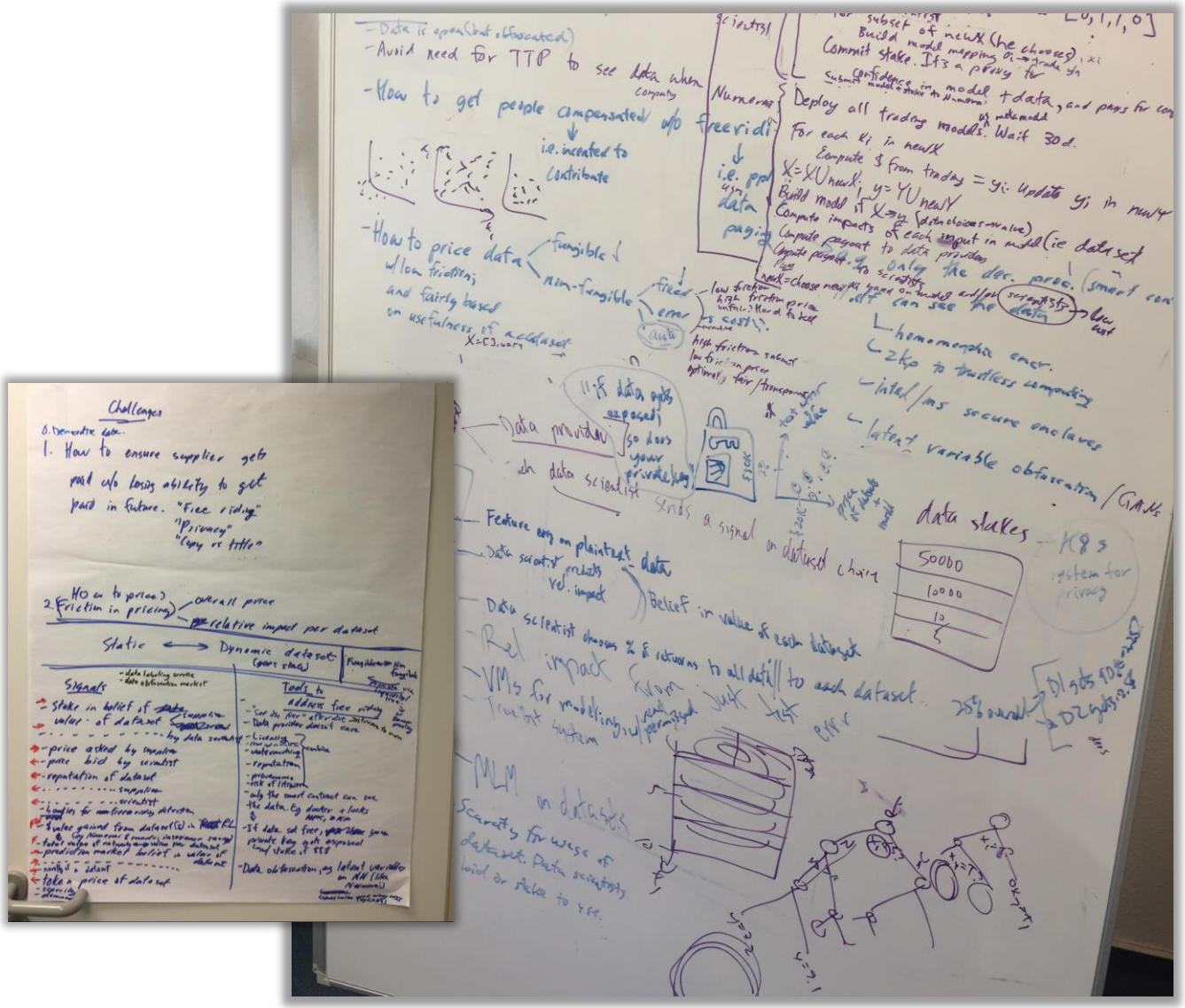
Token design practice

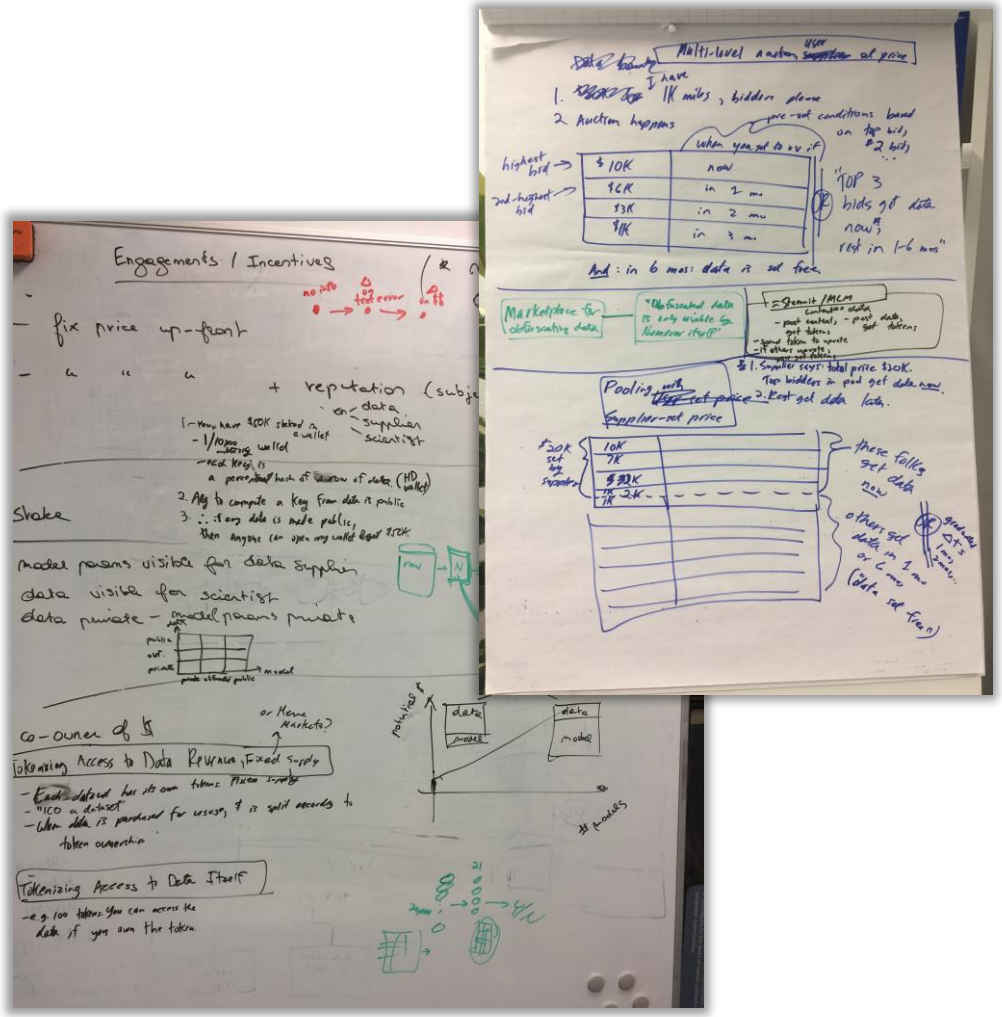






Token design practice: the default is to flail. To fail?





Realizations:

1. Tokenized ecosystems are evolutionary systems.

2. Therefore design ≈ evolutionary algorithm design!

Steps in EA Design

1. **Formulate the problem.** Objectives, constraints, design space.
2. **Try an existing EA solver.** If needed, try different problem formulations or solvers.
3. **Design new solver?**

1. Formulation of optimization problem

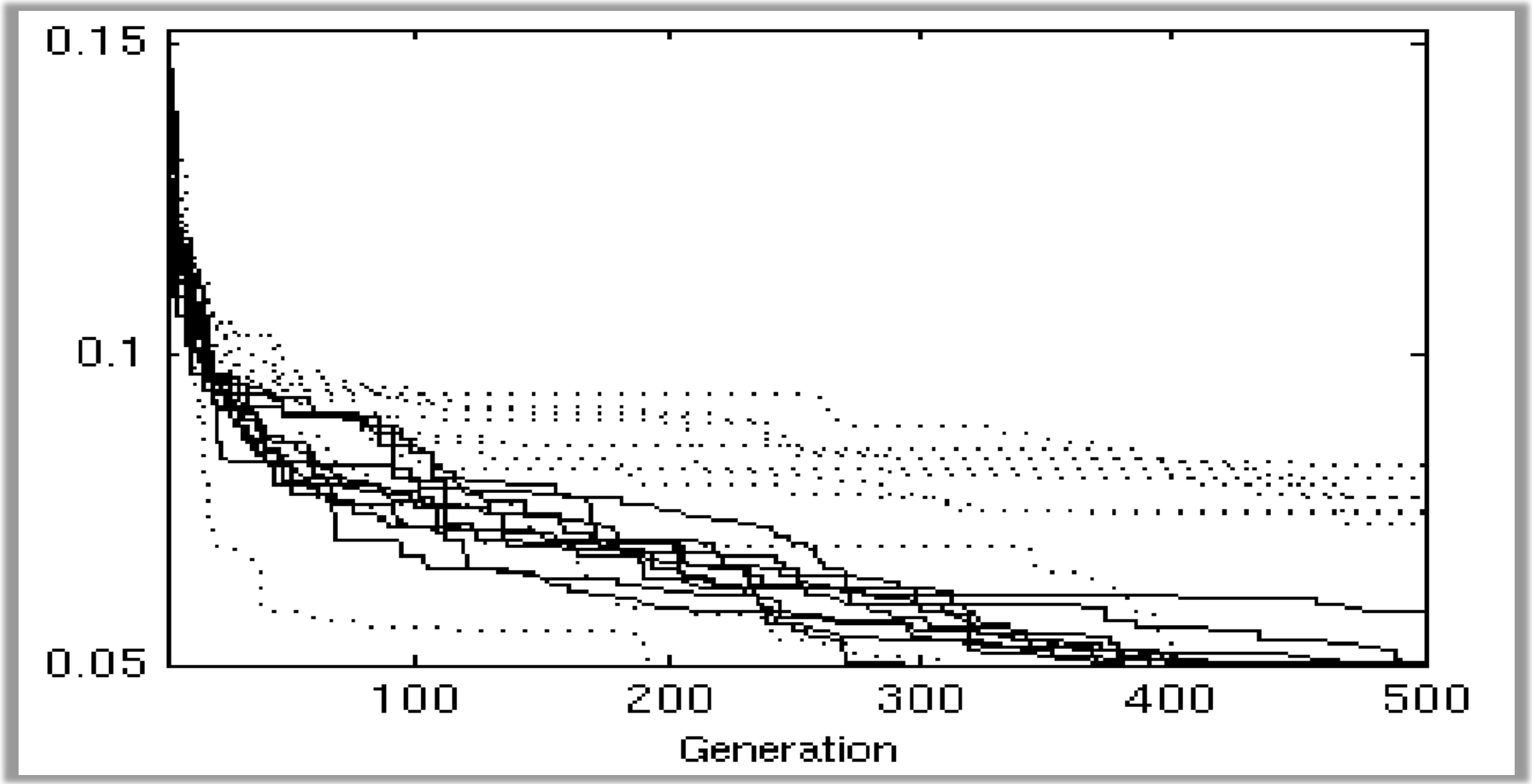
Objectives & constraints in a design space

The algorithm's aim is formulated as a constrained multi-objective optimization problem

$$\begin{aligned} \text{minimize} \quad & f_i(\phi) && i = 1 \ldots N_f \\ \text{s.t.} \quad & g_j(\phi) \leq 0 && j = 1 \ldots N_g \\ & h_k(\phi) = 0 && k = 1 \ldots N_h \\ & \phi \in \Phi \end{aligned} \tag{1}$$

where Φ is the "general" space of possible topologies and sizings. The algorithm traverses Φ to return a Pareto-optimal

2. Try an existing EA solver. Does it converge?



3. Design new EA solver

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TABLE II
PROCEDURE SANGRIAOPTIMIZATION()

Inputs: D, N_a, K, $N_L(k)$
Outputs: $\boldsymbol{d}^*$

1. $N_{gen} = 0$; $P = \emptyset, P_{all} = \emptyset$
2. while stop() $\neq True$:
3. if $(N_{gen} \% N_a) = 0$:
4. if $|P| < K$:
5. $P_{|P|+1} = \emptyset$
6. P_0 = SpaceFillIndividuals$(N_L(k), N_D, D)$
7. for $k = 1$ to $|P|$:
8. P_k = SelectParents$(P_k, P_{k-1}, N_L(k))$
9. $P_{k,j}$ = UpdateLocalOptState$(P_{k,j}, k)$, $j = 1$ to $|P_k|$
10. P_{all} = unique$(P_{all} \cup P)$
11. $P_{|P|} = P_{|P|} \cup$ InnerOptimize(P_{all}, D, k)
12. $\boldsymbol{d}^* = \boldsymbol{d_i}$ in P_{all} with highest Y or Cpk
13. $N_{gen} = N_{gen} + 1$
14. return $\boldsymbol{d}^*$

and all individuals encountered so far in the search, P_{all}.
Lines 2–13 are the generational loop, which repeats until stop

Steps in *Token Ecosystem* Design

1. **Formulate the problem.** Objectives, constraints, design space.
2. **Try an existing building block.** If needed, try different formulations or EA solvers.
3. **Design new building block?**

1. Formulate the Problem: [ex. Ocean]

Who are stakeholders? What do they want?

Key stakeholders in Ocean ecosystem

Stakeholder	What value they can provide	What they might get in return
Data/service provider, data custodian, data owner	Data/service (market's supply)	Tokens for making available / providing service
Data/service referrers, curators. Includes exchanges and other application-layer providers.	Data/service (via a provider etc), curation	Tokens for curating
Data/service verifier. Includes resolution of linked proofs on other chains	Data/service (via a provider etc), verification	Tokens for verification
Data/service consumer	Tokens	Data/service (market's demand)
Keepers	Correctly run nodes in network	Tokens for chainkeeping

Objectives & constraints

Obj:

- **Maximize supply of relevant data**

Constraints = checklist:

- **For priced data, is there incentive for supplying more? Referring? Spam prevention?**
- **For free data, "" ?**
- **Does the token give higher marginal value to users vs. hodlers?**
- **Are people incentivized to run keepers?**
- **Is it simple? Is onboarding low-friction?**

2. Try Existing Patterns

1. **Curation**
2. Proofs of human or compute work
3. Identity
4. Reputation
5. Governance / software updates
6. Third-party arbitration
7. …

2. Try existing patterns: evaluate on objectives & constraints. [Ex Ocean: None passed…]

Key Question	1	2	3	4
For priced data: incentive for supplying more? Referring?	✗	≈	✓	≈
For priced data: good spam prevention?	≈	✓	✓	✓
For free data: incentive for supplying more? Referring?	✗	≈	✗	✓
For free data: good spam prevention?	≈	✓	≈	✓
Does token give higher marginal value to users of the network, vs external investors? Eg Does return on capital increase as stake increases?	✓	✓	✓	✓
Are people incentivized to run keepers?	≈	≈	✓	✓
It simple? Is onboarding low-friction? Where possible, do we use incentives/crypto rather than legal recourse?	✓	✓	≈	≈

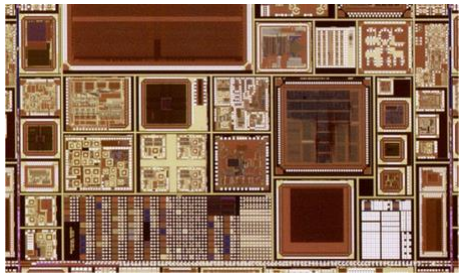
3. Try new patterns: evaluate on objectives & constraints. [Ex Ocean: pass!]

Key Question	1	2	3	4	5	6
For priced data: incentive for supplying more? Referring?	✗	≈	✓	≈	≈	✓
For priced data: good spam prevention?	≈	✓	✓	✓	✓	✓
For free data: incentive for supplying more? Referring?	✗	≈	✗	✓	✓	✓
For free data: good spam prevention?	≈	✓	≈	✓	≈	✓
Does token give higher marginal value to users of the network, vs external investors? Eg Does return on capital increase as stake increases?	✓	✓	✓	✓	✓	✓
Are people incentivized to run keepers?	≈	≈	✓	✓	✓	✓
It simple? Is onboarding low-friction? Where possible, do we use incentives/crypto rather than legal recourse?	✓	✓	≈	≈	✓	✓

On Tools

Tools

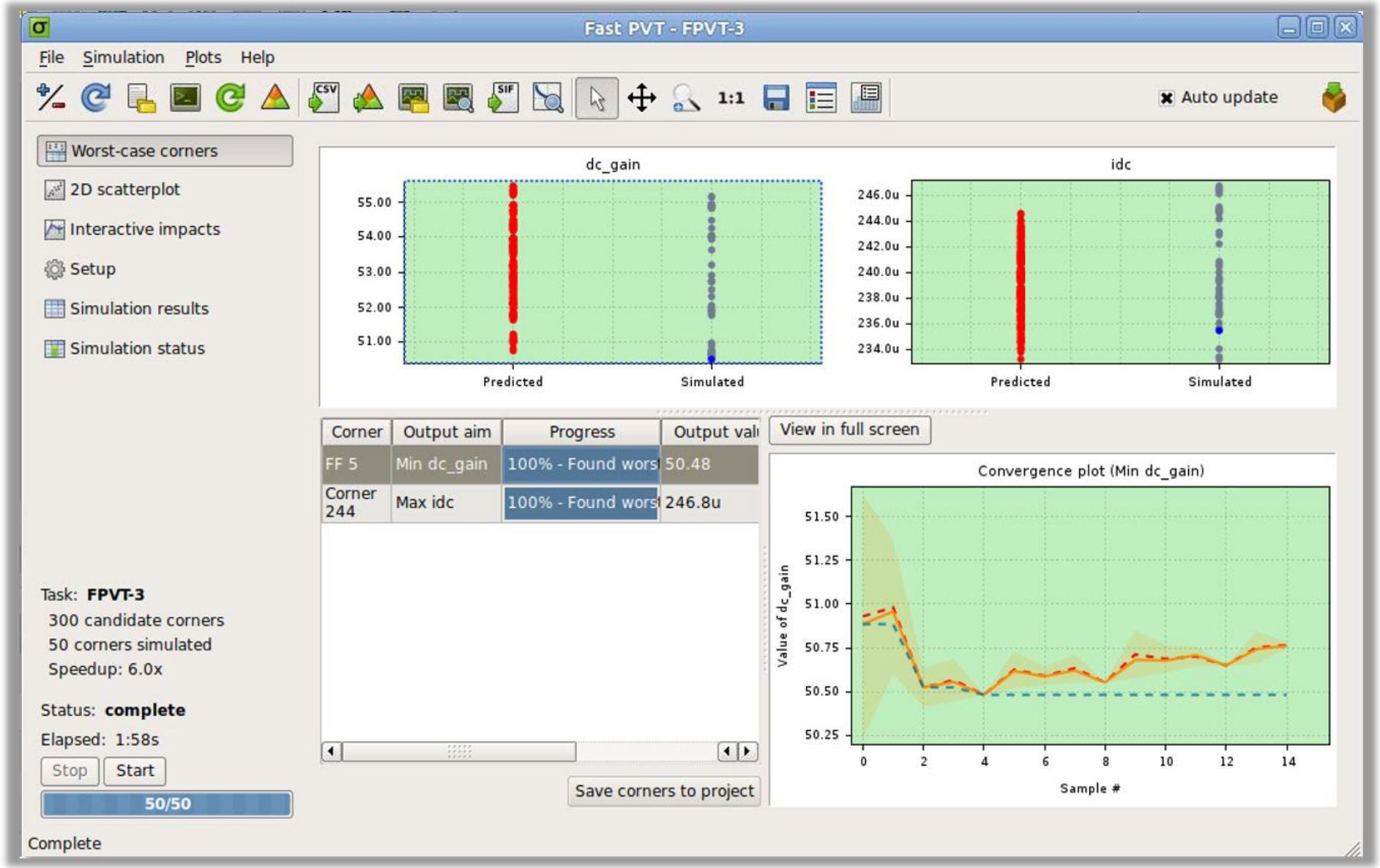
Q: How do we design circuits?
($50M+ at stake)



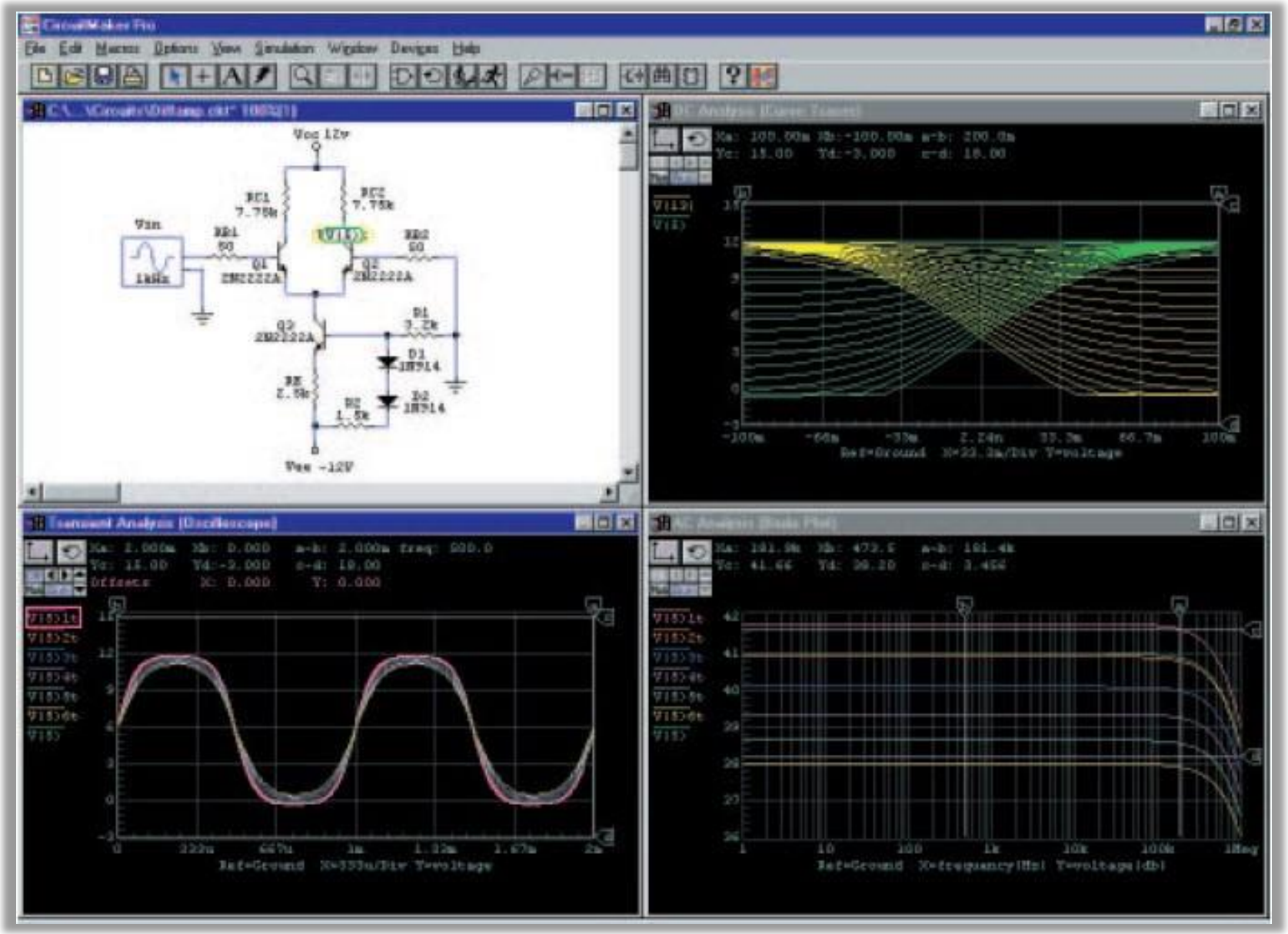
A: **CAD Tools** for

- Simulation,
- Verification, and
- Design

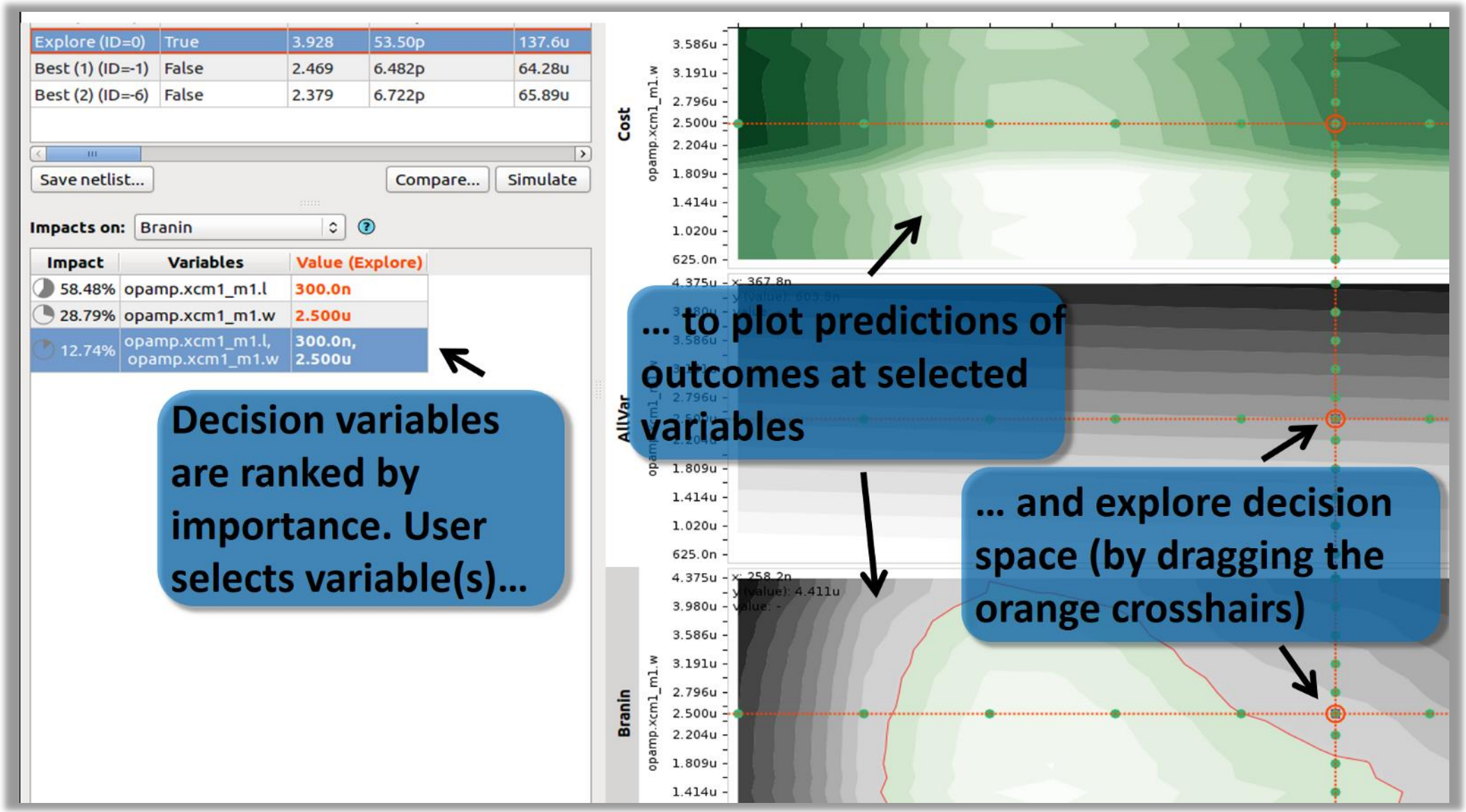
Verification across Worst-Case Conditions



Simulation of Circuit Dynamics



Interactive Design / Exploration



Tools for Tokenized Ecosystems?

- **Simulation? _____**
- **Verification? _____**
- **Design? ___**

- **We have tokenized ecosystems to design, $1B at stake**
- **are designing tokenized ecosystems…**
- **Without tools**
- **Which means we might be getting it all wrong! 😱**

Towards Token *Engineering*

Design of Tokenized Ecosystems
From Mechanism Design to *Token Engineering*

Analysis:

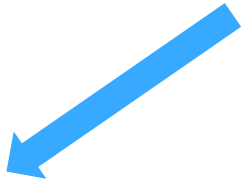
Game theory

Synthesis:

Mechanism Design

Practical constraints

Optimization Design



Engineering theory, practice and tools + responsibility

Token Engineering for Analysis & Synthesis

Engineering 

is the creative application of science, mathematical methods, and empirical evidence

to the innovation, design, construction, operation and maintenance

of structures, machines, materials, devices, systems, processes, and organizations.

Engineering Responsibility

Engineering has

Theory,
Practice,
Tools,
Responsibility

Science ←→ Engineering

- **Engineering** is about building things that work.
- **Science** is about contributing new knowledge.
- They're complementary.

Therefore **token engineering** is complementary to the science of cryptoeconomics / **token economics**.

Towards a Token Engineering *Community*

TE → TE Community

- A pleasant surprise to me: “Token Engineering” resonated with a *lot* of people
- And many new connections for me.
- Many amazing conversations.
- **A collective realization: we need to share knowledge, to learn from each other!**

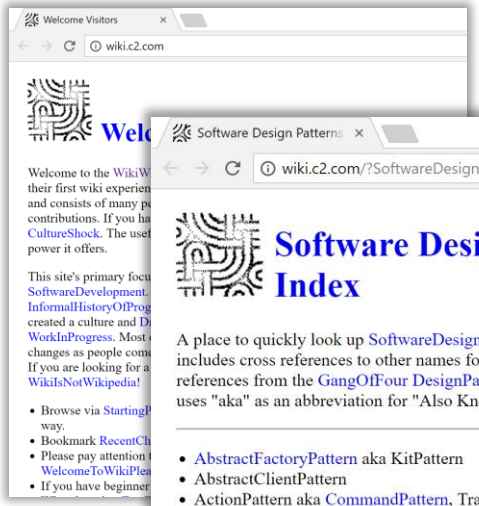
Mission of the TE Community

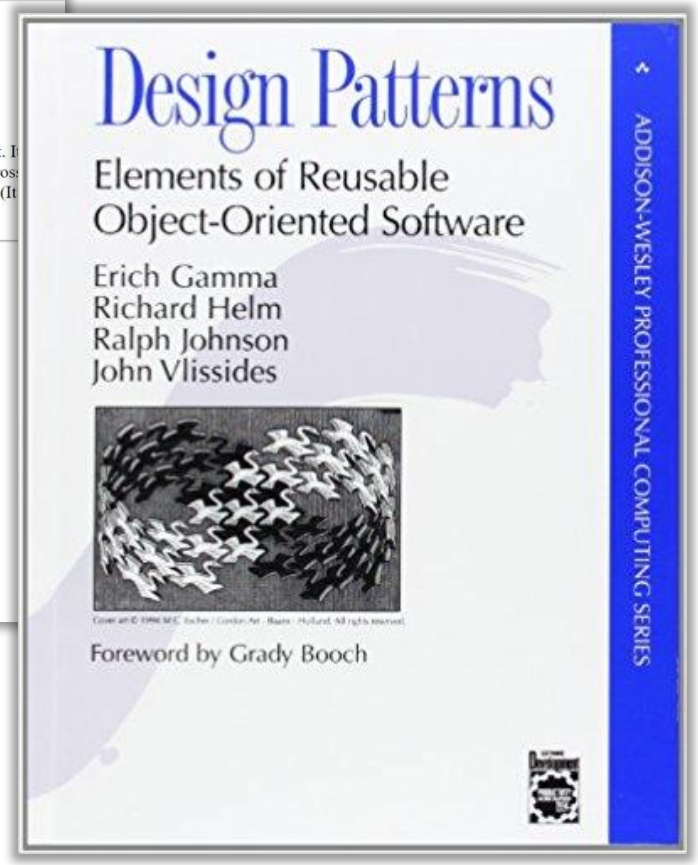
To grow TE into an **engineering discipline**

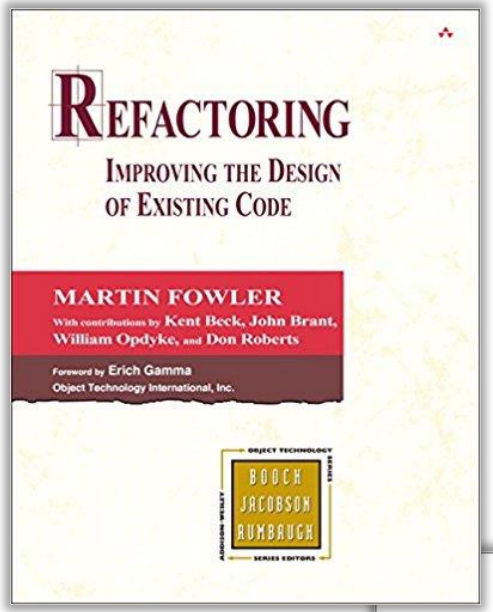
collectively as a community

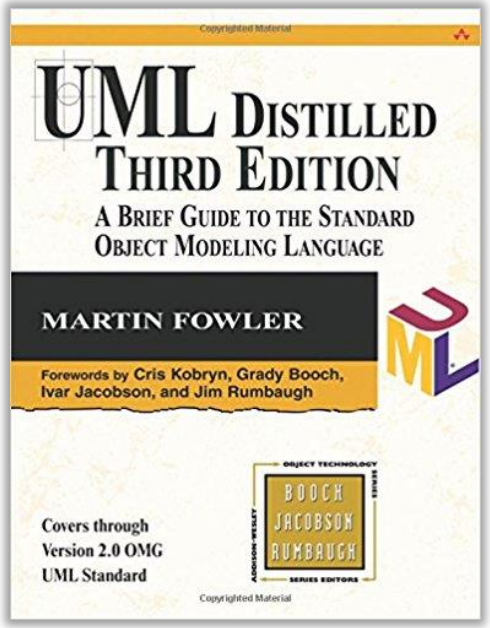
in a decentralized, permissionless, open-source fashion that all can contribute to and all can use.

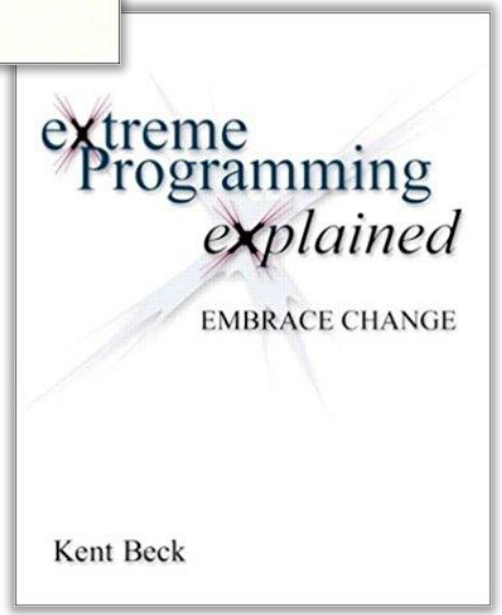
An inspiration: evolution of software engineering. C2 wiki → 💥



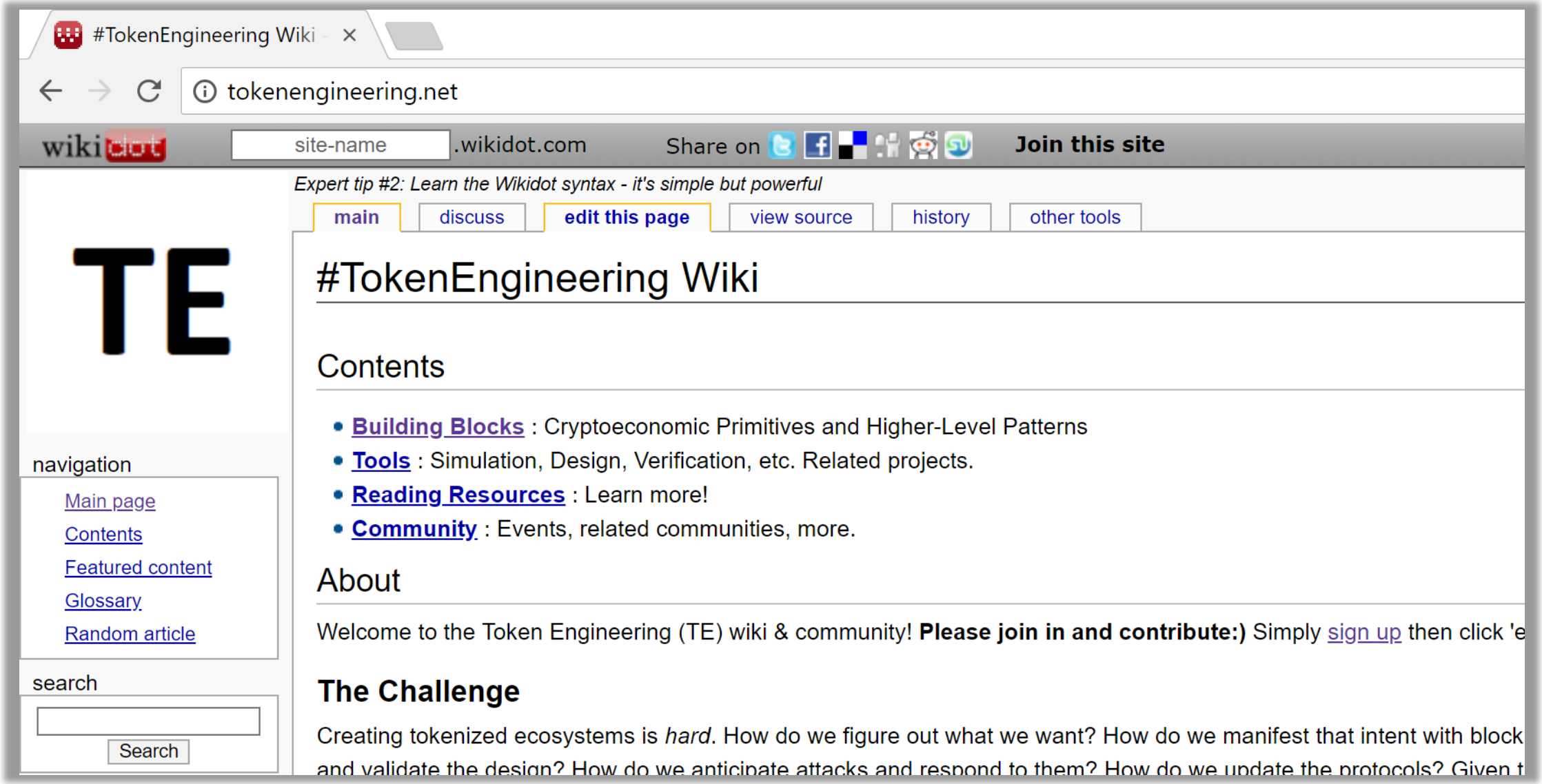








A Wiki for TE: tokenengineering.net



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Main page
Contents
Featured content
Glossary
Random article

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Search

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Building Blocks

Building Blocks : Cryptoeconomic Primitives and Higher-Leve

Types of blocks (highest level) (one framing)

- Proofs of human or machine work
- Curation
- Identity
- Micro-Economical: DAOs, Stablecoins, etc
- Consensus: Voting, staking, etc
- Reputation
- Governance / software updates
- Third-party arbitration
- Inter-operability
- «add to me! revise me! :)»

Other Framings

Other ways to frame or group building blocks include: «FIXME: add links to these. Th

- How tokens are distributed. This includes releasing coins for “work”, according to a more.
- Ethereum token standards, such as ERC20 fungible token and ERC721 non-fungi
- How tokens are valued. As a means of exchange, store of value, and unit of accou

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- Main page
- Contents
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Tools

Tools : Simulation, Design, Verification, etc. Related projects

Tools for Simulation & Verification

- Incentivai – test smart contract mechanism design via simulation using AI agents
- Related: there's lots of work on formal verification of smart contracts. That covers straight
  is what a token simulator could do.
- Related: circuit simulators like SPICE which simulate dynamical systems
- Related: dynamical systems simulators in other fields
- Related: agent-based simulators in other fields
- «add to me»

Tools for Design

- Related: computer-aided design (CAD) tools in other fields. E.g. in the Electronic Design
- «add to me»

Other Related Projects

- BlockScience – a technology research and analytics firm specializing in the design and ev
- Policy Design Lab - «FIXME: what is this»

Reading Resources

Related Disciplines

- Mechanism Design
- Algorithmic Game Theory
- Economic Systems Design
- Game Mechanics Design
- Systems Engineering
- Publicy Policy Analysis & Design
- Swarm Robotics
- Operations Research

Reading Resources

- Alex Evans, A Crash Course in Mechanism Design for Cryptoeconomic Applications, Oct 2017
- Trent McConaghy, Towards a Practice of Token Engineering Part I, Part II, Part III, Feb 2018
- Michael Zargham, On Engineering Economic Systems Part I, Part II, Mar 2018
- Elad Verbin, Behavioral Crypto-Economics: The Challenge and Promise of Blockchain Incentive Design, Mar 2018
- Jacob Horne, The Emergence of Cryptoeconomic Primitives
- Chris Burniske, The Crypto J-Curve, Aug 2017
- Chris Burniske, Cryptoasset Valuations, Sept 2017
- Adrian Colyer, Designing Secure Ethereum Smart Contracts - a Finite State Machine Approach, Mar 2018
- «add to me» «and start to group these more:) »

Community

Community: Events, Related Communities, more.

Upcoming Events

- Sun May 13, 2018 - NYC. Approx 12pm-6pm. This is the day before Co
  at TE NYC meetup page
- «your event?»

TE Meetup Groups

(The actual meetup.com pages will typically have the most up-to-date info)

- Meetup: TE Berlin
- Meetup: TE NYC
- Meetup: TE Toronto

Wanna start your own TE meetup? Please do! :) :) You can link to it here. I

Related Communities

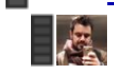
- Cryptoeconomics Hub. Madrid meetup, YouTube Channel
- Curation markets chat channel <link needed!>
- «Add to me»

Ways to Participate

- Edit this wiki and impart your wisdom! Add blocks, tools, readings.
- Tweet with #tokenengineering hashtag
- Attend a meetup (see Events). Or: start your own!
- Subscribe to the TE mailing list:

Email Address

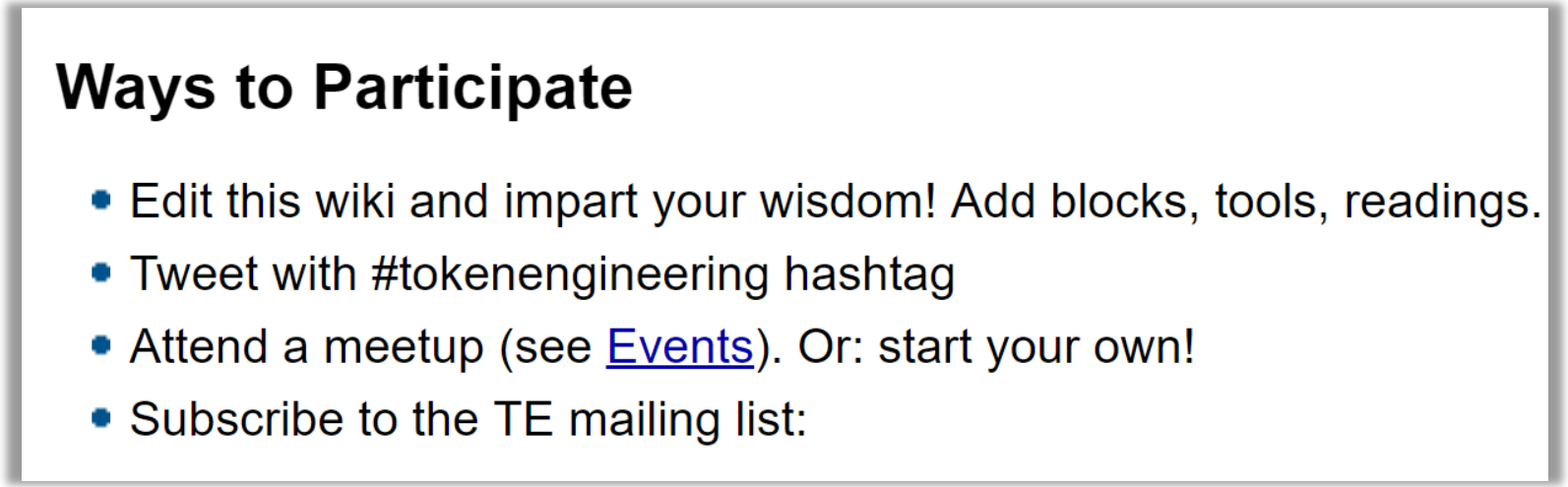
Subscribe

;-) dan-coincrunch
;-) achill rudolph
;-) Eden Dhaliwal
;-)
morganmoskalyk
;-) Frederik Bussler
;-) hodlhands
;-)
AngelaKreitenweis
;-) adriankrion
;-) cburniske
 Or Luis Shemtov
 bmann
;-)

Conclusion

Towards a #TokenEngineering Community

- **Token Engineering** = Theory + practice + tools + responsibility in the creation of tokenized ecosystems.
- One framing: like an EA. We'll see other approaches today.
- **TE is a field we can all create together. Now is the time to start:)**



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